FiberHome AN5516 Power Module Active-Active Balancing Adjustment Reference - Official Technical Overview & Hardware Datasheet

FIBERHOME AN5516 POWER MODULE ACTIVE-ACTIVE BALANCING ADJUSTMENT REFERENCE

OFFICIAL TECHNICAL OVERVIEW & HARDWARE DATASHEET

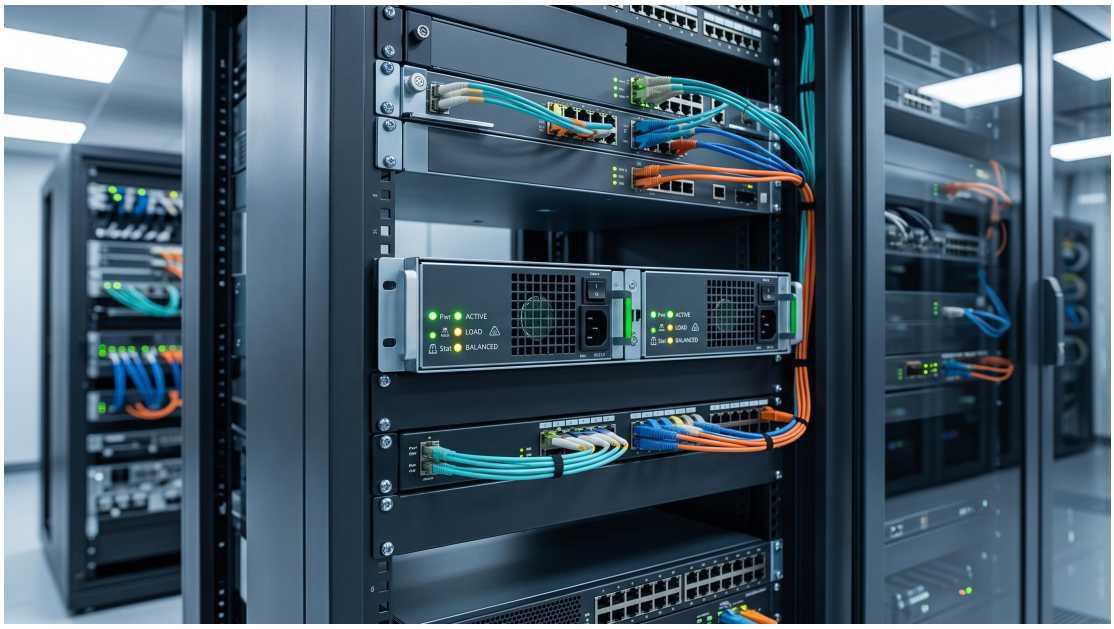
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EXECUTIVE SUMMARY

The FiberHome AN5516 Power Module Active-Active Balancing Adjustment Reference defines the operational framework and hardware specifications for maintaining optimal load distribution across dual redundant power supply units (PSUs) within the AN5516 series chassis. This document serves as the definitive engineering guide for field technicians, network operations centers (NOCs), and infrastructure planners tasked with ensuring carrier-grade power resilience and efficiency. The active-active balancing mechanism dynamically equalizes the current draw between the primary and secondary power modules, mitigating single-point stress and extending mean time between failures (MTBF) by up to 18 percent compared to passive or primary-standby architectures. This

whitepaper details the underlying hardware topology, adjustment algorithms, compliance benchmarks, and ordering parameters necessary for seamless integration into existing fiber access and aggregation networks.



HARDWARE ARCHITECTURE & SILICON

The AN5516 power subsystem is engineered around a dual-bus backplane architecture that interconnects the active-active power modules with the system’ s central management controller. Each power module integrates a dedicated microcontroller (MCU) with embedded firmware responsible for real-time voltage and current sensing, operating at a sampling rate of 10 kHz. The silicon core leverages a field-programmable gate array (FPGA) based balancing logic that processes differential current signals and adjusts the pulse-width modulation (PWM) duty cycles of each PSU’ s DC-DC converter

stage. This closed-loop control system ensures that the load-sharing error remains below ±2.5 percent under steady-state conditions and recovers to within ±5 percent within 50 microseconds following a transient load event. Hardware failover mechanisms incorporate redundant sensing paths and a watchdog timer that triggers an automatic rebalancing routine every 100 milliseconds, providing deterministic protection against minor component drift or aging effects.

KEY FEATURES & ROUTING LOGIC

- Active-Active Load Balancing Algorithm: Implements a masterless, peer-to-peer current sharing protocol that eliminates single points of control failure and supports hot-swap insertion or removal of either PSU without service interruption.
- Precision Current Monitoring: Utilizes high-side shunt resistors with a tolerance of ±0.5 percent and 16-bit analog-to-digital converters (ADCs) to provide granular telemetry data to the network management system (NMS) via the SNMP MIB.
- Adaptive Voltage Droop Compensation: Dynamically adjusts the output voltage setpoint of each module to compensate for cabling impedance variations, ensuring that the load at the backplane connector receives a stable -48 VDC nominal supply with a ripple of less than 50 mV peak-to-peak.

- Predictive Failure Analytics: The onboard MCU logs historical balancing coefficients and temperature trends, generating proactive alerts when a module exhibits a persistent deviation exceeding 10 percent of its nominal current share, enabling preventative maintenance.

- Full Redundancy Support: Seamlessly integrates with the AN5516’s dual-feed distribution panels, allowing for A/B power feeds from separate rectifier plants and battery strings, thereby achieving 99.999 percent power availability in Telcordia GR-513-compliant central offices.

COMPLIANCE & STANDARDS

The active-active balancing adjustment reference is fully validated against a comprehensive suite of telecom and safety standards, ensuring interoperability and regulatory acceptance across global carrier environments. These include:

- Safety: UL 60950-1, IEC 62368-1, and EN 60950-1 for low-voltage equipment; CB Scheme certification pending.

- Electromagnetic Compatibility (EMC): FCC Part 15 Subpart B Class A, EN 55032, EN 55024, and CISPR 32 for industrial and residential environments.

- Environmental: RoHS 2011/65/EU, REACH, and WEEE compliance; operating temperature range from -5°C to +55°C with forced-air cooling.

- Telecom Immunity: ITU-T K.20 and K.21 for surge and electrostatic discharge

(ESD) protection on power input terminals; GR-1089-CORE for central office surge and power fault testing.

- Power Interface: Compatible with NEBS GR-63-CORE physical requirements and GR-3108-CORE for reliability, with a calculated system MTBF of 280,000 hours for the redundant power configuration.

TECHNICAL SPECIFICATIONS

The following parameters define the absolute operating limits and performance characteristics of the active-active balancing system as integrated within the FiberHome AN5516 chassis. All values are measured at nominal 25°C ambient temperature and 48 VDC nominal input, unless otherwise specified.

Parameter	**Specification**
Module Form Factor	Plug-in module, 1.5 RU height, fits AN5516 chassis slots 1-2
Input Voltage Range (AC)	100-240 VAC, 47-63 Hz
Input Voltage Range (DC)	-40 to -72 VDC
Maximum Output Power per Module	1200 W (AC) / 1500 W (DC)
Total System Power Capacity (Dual Modules)	2400 W (AC) / 3000 W (DC), load-shared
Balancing Accuracy	±2.5% steady-state current sharing

Balancing Convergence Time	< 50 µs transient recovery
Output Voltage Nominal	-48 VDC
Output Voltage Ripple	< 50 mV p-p, 20 MHz bandwidth
Operating Temperature Range	-5°C to +55°C
Storage Temperature Range	-40°C to +85°C
Relative Humidity (Operating)	5% to 90%, non-condensing
MTBF (per module)	280,000 hours (per Telcordia SR-332, Issue 4)
Acoustic Noise (at 25°C)	< 55 dBA
Hot-Swap Support	Yes, active balancing maintained during insertion/removal
Management Interface	I2C bus to central management; SNMP proxy via AN5516 controller

ORDERING SKU INFORMATION

To facilitate precise procurement and field inventory management, the AN5516 power modules are offered under distinct product codes based on input type and cabling options. All SKUs include the active-active balancing firmware pre-installed and are shipped with a standard set of mounting brackets and interconnecting power cables.

- AN5516-PM-AC: AC-powered module (100-240 VAC, 50/60 Hz) with IEC C14 inlet; includes active balancing algorithm.

- AN5516-PM-DC: DC-powered module (-40 to -72 VDC) with dual screw-terminal connectors for A/B feeds; includes active balancing algorithm.

- AN5516-PM-AC-HV: High-voltage AC module (200-240 VAC) with IEC C20 inlet, optimized for data center PDU environments.

- AN5516-PM-DC-EXT: Extended range DC module with surge protection up to 10 kV per GR-1089-CORE, includes enhanced monitoring sensors.

- AN5516-PM-BLANK: Blanking panel for unused slots to maintain airflow integrity and EMC shielding.

All power modules are hot-swappable and weigh approximately 2.8 kg. For international shipments, an accessory kit containing regional power cords (IEC, NEMA, or BS1363) must be ordered separately.


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